IN THE CLAIMS

Claim 1 (currently amended): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate directly coupled a first conductor to receive an input voltage, and a source coupled to a supply voltage conductor;

(b) a control circuit for producing a limit voltage, the control circuit having a first terminal coupled to a second conductor for conducting a control signal and a second terminal coupled to a third conductor for conducting the limit voltage;

(c) a voltage clamping circuit having a first terminal coupled to the third conductor to receive the limit voltage and a second terminal coupled to the first conductor to receive the input voltage; and

(d) the control circuit and the voltage clamp circuit coacting to limit a current in the output transistor to a maximum value determined by the control signal.

Claim 2 (currently amended): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate directly coupled a first conductor to receive an input voltage, and a source coupled to a supply voltage conductor;

(b) a control circuit for producing a limit voltage, the control circuit having a first terminal coupled to a second conductor for conducting a control signal and a second terminal coupled to a third conductor for conducting the limit voltage;

(c) a voltage clamping circuit having a first terminal coupled to the third conductor to receive the limit voltage and a second terminal coupled to the first conductor to receive the input voltage; and

(d) the control circuit and the voltage clamp circuit coacting to electrically isolate the first conductor from the third conductor when the magnitude of the input voltage exceeds the magnitude of the limit voltage and to prevent a current in the output

transistor from increasing enough to exceed a maximum current limit determined by the control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage.

Claim 3 (original): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate coupled a first conductor to receive an input voltage and a source coupled to a supply voltage conductor;

(b) a control circuit for producing a limit voltage, the control circuit having a first terminal coupled to a second conductor for conducting a control signal and a second terminal coupled to a third conductor for conducting the limit voltage;

(c) a voltage clamping circuit having a first terminal coupled to the third conductor to receive the limit voltage and a second terminal coupled to the first conductor to receive the input voltage;

(d) the control circuit and the voltage clamp circuit coacting to electrically isolate the first conductor from the third conductor when the magnitude of the input voltage exceeds the magnitude of the limit voltage and to prevent a current in the output transistor from increasing enough to exceed a maximum current limit determined by the control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage;

(e) wherein the voltage clamping circuit includes a first transistor having an emitter coupled to the third conductor and a base and collector both coupled to a bias current source, and a second transistor having a base coupled to the base and collector of the first transistor, an emitter coupled to the first conductor, and a collector coupled to the supply voltage conductor.

Claim 4 (original): The electronic circuit of claim 3 wherein the output transistor is a P-channel transistor, and wherein the first and second are NPN transistors.

Claim 5 (original): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate coupled a first conductor to receive an input voltage, and a source coupled to a supply voltage conductor;

(b) a control circuit for producing a limit voltage, the control circuit having a first terminal coupled to a second conductor for conducting a control signal and a second terminal coupled to a third conductor for conducting the limit voltage;

(c) a voltage clamping circuit having a first terminal coupled to the third conductor to receive the limit voltage and a second terminal coupled to the first conductor to receive the input voltage;

(d) the control circuit and the voltage clamp circuit coacting to electrically isolate the first conductor from the third conductor when the magnitude of the input voltage exceeds the magnitude of the limit voltage and to prevent a current in the output transistor from increasing enough to exceed a maximum current limit determined by the control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage;

(e) wherein the voltage clamping circuit includes a first transistor having an emitter coupled to the third conductor and a base and collector both coupled to a bias current source, a second transistor having a base coupled to the base and collector of the first transistor, an emitter coupled to the first conductor, a third transistor having an emitter coupled to the third conductor, a base coupled to the base and collector of the first transistor, and a collector coupled to a drain and gate of a fourth transistor having a source coupled to the supply voltage conductor, a fifth transistor having a source coupled to the supply voltage conductor, a gate coupled to the gate and drain of the fourth transistor, and a drain coupled to a collector of the second transistor, and a sixth transistor having a source coupled to the supply voltage conductor, a gate coupled to the collector of the second transistor, and a drain coupled to the first conductor;

wherein the third, fourth, fifth, and sixth transistors coact to cause additional current to flow in the first conductor as needed to prevent the current in the output transistor from increasing enough to exceed a maximum current limit determined by the

control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage.

Claim 6 (original): The electronic circuit of claim 5 wherein the output transistor and the fourth, fifth, and sixth transistors are P-channel transistors, and wherein the first, second, and third transistors are NPN transistors.

Claim 7 (currently amended): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate directly coupled to a first conductor receive an input voltage, and a source coupled to a supply voltage conductor;

(b) a current-to-voltage converter circuit for producing a limit voltage in response to a reference current, the current-to-voltage converter circuit having a first terminal for conducting the reference current, a second terminal for conducting the limit voltage, and a third terminal connected to the output terminal of the electronic circuit;

(c) a voltage clamping circuit having a first terminal coupled to the second terminal of the current-to-voltage converter to receive the limit voltage, and a second terminal coupled to the gate of the output transistor to receive the input voltage, the output transistor; and

(d) the current-to-voltage converter circuit, and the voltage clamp circuit coacting to limit the current in the output transistor to a maximum value determined by the reference current.

Claim 8 (currently amended): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate directly coupled to receive an input voltage, and a source coupled to a supply voltage conductor;

(b) a current-to-voltage converter circuit for producing a limit voltage in response to a reference current, the current-to-voltage converter circuit having a first

terminal for conducting the reference current, a second terminal for conducting the limit voltage, and a third terminal connected to the output terminal of the electronic circuit;

(c) a voltage clamping circuit having a first terminal coupled to the third conductor to receive the limit voltage and a second terminal coupled to the first conductor to receive the input voltage;

(d) the control circuit and the voltage clamp circuit coacting to electrically isolate the first conductor from the third conductor when the magnitude of the input voltage exceeds the magnitude of the limit voltage and to prevent a current in the output transistor from increasing enough to exceed a maximum current limit determined by the control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage.

Claim 9 (original): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate coupled to receive an input voltage, and a source coupled to a supply voltage conductor;

(b) a current-to-voltage converter circuit for producing a limit voltage in response to a reference current, the current-to-voltage converter circuit having a first terminal for conducting the reference current, a second terminal for conducting the limit voltage, and a third terminal connected to the output terminal of the electronic circuit;

(c) a voltage clamping circuit having a first terminal coupled to the third conductor to receive the limit voltage and a second terminal coupled to the first conductor to receive the input voltage;

(d) the control circuit and the voltage clamp circuit coacting to electrically isolate the first conductor from the third conductor when the magnitude of the input voltage exceeds the magnitude of the limit voltage and to prevent a current in the output transistor from increasing enough to exceed a maximum current limit determined by the control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage;

(e) wherein the voltage clamping circuit includes a first transistor having an emitter coupled to the third conductor and a base and collector both coupled to a bias current source, and a second transistor having a base coupled to the base and collector of the first transistor, an emitter coupled to the first conductor, and a collector coupled to the supply voltage conductor.

Claim 10 (original): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate coupled to receive an input voltage, and a source coupled to a supply voltage conductor;

(b) a current-to-voltage converter circuit for producing a limit voltage in response to a reference current, the current-to-voltage converter circuit having a first terminal for conducting the reference current, a second terminal for conducting the limit voltage, and a third terminal connected to the output terminal of the electronic circuit;

(c) a voltage clamping circuit having a first terminal coupled to the third conductor to receive the limit voltage and a second terminal coupled to the first conductor to receive the input voltage;

(d) the control circuit and the voltage clamp circuit coacting to electrically isolate the first conductor from the third conductor when the magnitude of the input voltage exceeds the magnitude of the limit voltage and to prevent a current in the output transistor from increasing enough to exceed a maximum current limit determined by the control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage;

(e) wherein the voltage clamping circuit includes a first transistor having an emitter coupled to the third conductor and a base and collector both coupled to a bias current source, a second transistor having a base coupled to the base and collector of the first transistor, an emitter coupled to the first conductor, a third transistor having an emitter coupled to the third conductor, a base coupled to the base and collector of the first transistor, and a collector coupled to a drain and gate of a fourth transistor having a source coupled to the supply voltage conductor, a fifth transistor having a source

coupled to the supply voltage conductor, a gate coupled to the gate and drain of the fourth transistor, and a drain coupled to a collector of the second transistor, and a sixth transistor having a source coupled to the supply voltage conductor, a gate coupled to the collector of the second transistor, and a drain coupled to the first conductor;

wherein the third, fourth, fifth, and sixth transistors coact to cause additional current to flow in the first conductor as needed to prevent the current in the output transistor from increasing enough to exceed a maximum current limit determined by the control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage.

Claim 11 (original): The electronic circuit of claim 10 wherein the output transistor and the fourth, fifth, and sixth transistors are P-channel transistors, and wherein the first, second, and third transistors are NPN transistors.

Claim 12 (original): An electronic circuit including an over-current protection circuit therein, the over-current protection circuit comprising:

(a) an output transistor having a drain coupled to an output terminal of the electronic circuit, a gate coupled to receive an input voltage, and a source coupled to a supply voltage conductor;

(b) a current-to-voltage converter circuit for producing a limit voltage in response to a reference current, the current-to-voltage converter circuit having a first terminal for conducting the reference current, a second terminal for conducting the limit voltage, and a third terminal connected to the output terminal of the electronic circuit;

(c) a voltage clamping circuit having a first terminal coupled to the third conductor to receive the limit voltage and a second terminal coupled to the first conductor to receive the input voltage;

(d) the control circuit and the voltage clamp circuit coacting to electrically isolate the first conductor from the third conductor when the magnitude of the input voltage exceeds the magnitude of the limit voltage and to prevent a current in the output transistor from increasing enough to exceed a maximum current limit determined by the

control signal when the magnitude of the input voltage is less than the magnitude of the limit voltage;

(e) wherein the current-to-voltage converter includes a sense transistor having a source coupled to the supply voltage conductor, a drain coupled to the first terminal, and a gate coupled to the second terminal, and an operational amplifier having an output coupled to the second terminal, a first input coupled to the first terminal, and a second terminal coupled to the output terminal.

Claim 13 (currently amended): A method of providing over-current protection in an output transistor of an electronic circuit, comprising:

(a) applying an input signal to a first conductor directly coupled to a gate of the output transistor to cause an output current to flow through the output transistor and an output terminal of the electronic circuit;

(b) applying a limit voltage to an input of a voltage clamping circuit; and

(c) operating the voltage clamping circuit to cause a clamping current to flow in the first conductor as needed to prevent the input signal from having a value that is beyond a predetermined level relative to the limit voltage wherein the output current is prevented from having a value greater than a current limit determined by the limit voltage.

Claim 14 (currently amended): A method of providing over-current protection in an output transistor of an electronic circuit, comprising:

(a) applying an input signal to a first conductor coupled to a gate of the output transistor to cause an output current to flow through the output transistor and an output terminal of the electronic circuit;

(b) applying a limit voltage to an input of a voltage clamping circuit; and

(c) operating the voltage clamping circuit to cause a clamping current to flow in the first conductor as needed to prevent the input signal from having a value that is beyond a predetermined level relative to the limit voltage wherein the output current is prevented from having a value greater than a current limit determined by the limit voltage,

~~The method of claim 13~~ wherein step (a) includes applying the input signal to the first conductor by means of an output of an amplifier circuit.

Claim 15 (currently amended): A method of providing over-current protection in an output transistor of an electronic circuit, comprising:

(a) applying an input signal to a first conductor coupled to a gate of the output transistor to cause an output current to flow through the output transistor and an output terminal of the electronic circuit;

(b) applying a limit voltage to an input of a voltage clamping circuit; and

(c) operating the voltage clamping circuit to cause a clamping current to flow in the first conductor as needed to prevent the input signal from having a value that is beyond a predetermined level relative to the limit voltage wherein the output current is prevented from having a value greater than a current limit determined by the limit voltage,

~~The method of claim 13~~ wherein step (b) includes applying a control signal to an input of a current-to-voltage conversion circuit to cause the current-to-voltage conversion circuit to produce the limit voltage.

Claim 16 (currently amended): A method of providing over-current protection in an output transistor of an electronic circuit, comprising:

(a) applying an input signal to a first conductor coupled to a gate of the output transistor to cause an output current to flow through the output transistor and an output terminal of the electronic circuit;

(b) applying a limit voltage to an input of a voltage clamping circuit; and

(c) operating the voltage clamping circuit to cause a clamping current to flow in the first conductor as needed to prevent the input signal from having a value that is beyond a predetermined level relative to the limit voltage wherein the output current is prevented from having a value greater than a current limit determined by the limit voltage,

~~The method of claim 13~~ wherein step (b) includes applying the limit voltage to an emitter of a first transistor having a collector in base connected to a bias current source,

and applying the resulting voltage on a base of the first transistor to a base of a second transistor, and step (a) includes applying the input signal to the first conductor.

Claim 17 (original): The method of claim 16 wherein step (c) includes operating the second transistor to cause the clamping current to flow into the first conductor whenever the input signal turns the second transistor on.

Claim 18 (original): The method of claim 16 wherein step (c) further includes operating a third transistor having a source coupled to the supply voltage conductor and having a drain coupled to the first conductor to cause an additional current to flow in the first conductor in response to the turning on all the second transistor.

Claim 19 (original): The method of claim 18 including operating a current mirror circuit in response to a collector current of a fourth transistor having a base and emitter connected to the base and emitter, respectively, of the first transistor to provide a load device coupled to a collector of the second transistor and applying a voltage of collector of the second transistor to a gate of the third transistor to turn the third transistor off when the second transistor is off and to turn the third transistor on when the second transistor is on.